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Coombs's Improvement in Stand Pipes.

We here present to our readers a highly novel and important invention, for which a patent is secured through our agency, dated November 28, 1871, for Moses Coombs, Jr., Youngstown, Ohio. We also call attention to further remarks on the editorial page.

The nature of the invention consists in surrounding the stand pipe with a concentric cylinder, or jacket, closed at the bottom, through which a continuous current of cold water is kept flowing, during the time occupied in carbonizing the charge of coal in the retort; the object of which is to prevent the walls of the stand-pipe from becoming highly heated, as is usual, especially with clay retorts and high heats, to temperatures which cause the tar to become concentrated and thickened to a pitchy consistence and caked on the walls of the stand-pipe, in such manner as completely to choke up the latter.

In my mode of operation, I am enabled to urge the heat to such high points, without the least danger of obstruction of the stand-pipes, that I can thus obtain, in the same time, from a bench of retorts, double the volume of gas, and moreover with great improvement in the illuminating power and the purity of the same. The tar which condenses in the stand-pipes is so fluid in its consistence that it readily flows back into the vestibule of the retort, and being in part carbonized again, adds to the volume and richness of the gas. Besides these advantages, there is less work thrown upon the condensers and scrubbers, and all danger of condensation of tar in the purifiers is obviated.

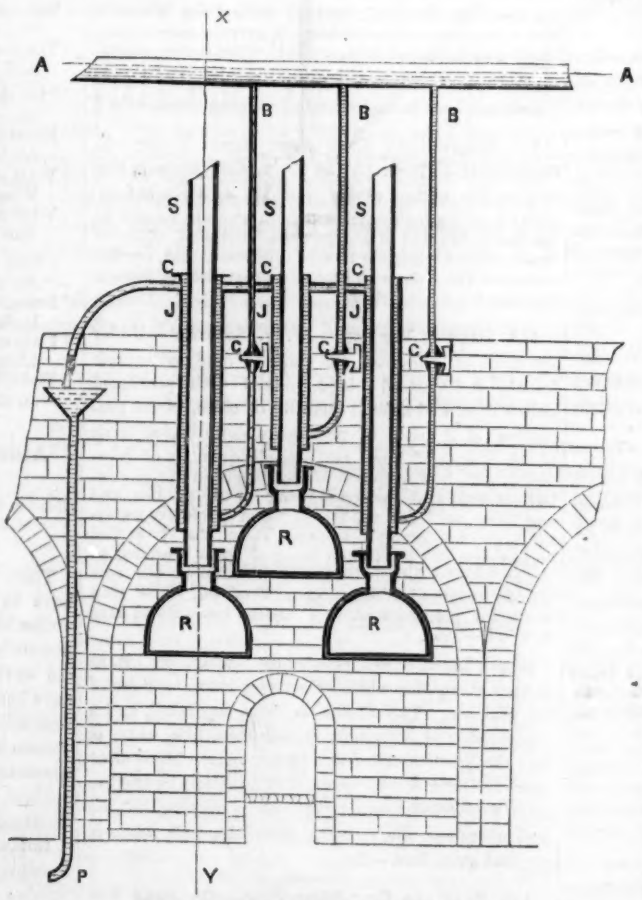
The figure (scale 1-24th) represents the front face of a bench of three retorts, RRR, to which my improvement is attached; with a vertical section of the latter, through the mouthpieces and stand-pipes, SSS, exhibiting the mode of supply to the water-jackets, and the mode of conducting off the overflow.

AA is the cold water main, or trough supplied with cold water, situated at such height as is necessary. This may be supported on the bridge-pieces of the stand-pipes, or in any other convenient way.

BBB are tubes, which I usually make of about half inch calibre, furnished with cocks, CCC, for conducting water from the cold water main, AA, to the lower ends of the water jackets, JJJ.

These jackets, JJJ, are of such dimensions as to leave a space for the water of from three quarters to one inch. OOO represents the overflow pipes, through which inter-communication is established (in a bench of threes) between the water jackets, and the overflow of all conducted to the funnel and waste-pipe, EP.

In benches of fives or sixes or larger numbers, there may, of course, be provided two, three, or more series of overflow pipes at different levels, in order more to equalize the heights or lengths of the water jackets. The arrangement of these will be obvious to any mechanic of ordinary skill, to detail them is unnecessary.



COOMBS'S IMPROVEMENT IN STAND PIPES.

While a bench of retorts is being first heated up, which occupies from ten to fourteen days, I find it of advantage to keep a slight flow of water through the jackets, which prevents the joints from burning out and leaking.

When the first charges are made, I increase the flow until the stream at F is from $\frac{1}{8}$th to $\frac{3}{8}$ths of an inch or more in diameter, according to the quantity of gas to be made. If water is abundant a $\frac{3}{8}$ths of an inch stream at least, is always advisable, but a smaller one will be beneficial. In a larger bench the stream should be enlarged in proportion.

Liquid Fuel.

We doubt very much if for ordinary furnaces, steam-boiler or heating furnaces, petroleum ever becomes an economical fuel or a feasible substitute for coal; but for special purposes it is equally plain that there are numerous opportunities for its successful operation.

These will be found under conditions where intensity and manageability of flame combined with power and rapid heating are essential. An example of this is found in welding machinery, in which the flame of a liquid hydrocarbon serves to maintain the metal at the requisite heat under circumstances where no coal furnace would give an equal degree of utility. The heating iron furnaces may or may not belong to the class just indicated, but the results achieved at the Laclede Rolling Mills in Missouri are such as to justify some hope in this direction. We find the apparatus and *modus operandi* described as follows:

"The oil is placed in a large tank, having a capacity of 100 barrels, situated about 200 feet from the furnace. From this tank it is pumped through an ordinary three-quarter inch pipe into a cylindrical generator, about four feet high and two and one-half feet in diameter. This generator contains about 600 copper tubes, each about five-eighths of an inch in diameter. In an adjoining fire-box steam is superheated to a temperature of about 800° Fah., thence passing through a pipe into the copper tubes of the generator. The great heat thus created in the tubes generates the oil which fills the intervening spaces into a gaseous vapor. As quickly as it is generated, it passes into a receiver, which covers the generator in the shape of a dome, and which is filled with sponges to regulate the flow of gas as it passes into pipes leading to the furnace. A jet of superheated steam is mixed with the gas in the receiver, and the oxygen thus supplied combines with the carbon of the vapor, forming a gas which burns readily and with intense heat without atmospheric aid. The supply of gas admitted into the furnace is regulated by a gauge in much the same manner as steam in a steam engine. The petroleum in the generator is kept constantly agitated by the admission of a small jet of superheated steam, which keeps the crude oil from depositing any residuum on the bottom or sides—thus preventing any accumulation of refuse, or leaving any sediment after the more

volatile portions of the oil are generated into vapor. On entering the furnace, the gas ignites at once rushing through in a white flame of intense heat, imparting to the iron over which it passes an appearance of semi-transparency. In the experiments at the Laclede Mills, the iron thus heated has been brought to a white heat in one hour, or one-fifth of the time required when coal is used for fuel.—*Am. Artisan.*

Chemical Repertory,

No. 60.—December 2, 1871.

EDITOR—HENRY WURTZ.

CHEMICAL EXCERPTS.

110. Beer Analysis.—E. Monier has reported to the French Academy the results of the analysis of 12 different samples of beer, six of which are brewed in France, the rest in other European countries. The sp. gr. of these samples varies from 1.008 to 1.023. The quantity of alcohol, by bulk (c.c. in 1000 grms), varies from 32.5 (a French brewed beer) to 60.5 (Burton pale ale); glucose, from 4.8 (French beer) to 16.30 (so-called Strasburg beer, but brewed at Paris) grms.; dextrine, albuminoid substances, etc., from 31.0 (French beer) to 58.40 (Munich, Bavarian beer) grms.; salts, from 1.50 (French beer) to 2.80 (Burton pale ale) grms.

111. Studies on the Coloring of Smoky Quartz, or So-called Smoked Topaz.—Prof. A. Forster.—With a view to determine whether the smoky appearance, which vanished when the specimens were heated to 200°, was due to allotropism, or to the existence of organic matter.

Heating the smoky quartz in a retort from which all access of organic matter was most carefully prevented, gave a product containing carbonate of ammonia, which proved the presence of organic matter.—*Am. Chemist.*

112. Method of Improving Spring-Water.—Dr. Schilling proposes that the sides and bottom of wells should be made perfectly watertight by means of masonry. Into the bottom wall is to be inserted a glazed earthenware tube or pipe, some feet in length, care being taken to cement it water tight into the bottom masonry; this tube should be filled, first with a layer of clean pebbles, next a layer of coarsely granulated charcoal, and next a layer of fine, white, clean sand, or other suitable filtering materials, through which the water of the well is forced to pass upwards, being thereby purified. The author states that the cleansing and renewing of the filtering materials will have to be occasionally attended to.

[The exchange from which we clip the above may have added or omitted something, but it is hard to see how Dr. Schilling gets his "spring-water" into such a well in the first place.]

113. Dry Distillation of Wood.—M. Maiche.—This industry does not pay unless the greatest care is taken to utilize advantageously all the products, which, for 100 kilos. of wood submitted to distillation, amount to 50 kilos. of raw produce, wherein are contained: Methylic alcohol (*wood spirit*) 2 kilos.; crystallisable acetic acid, 3 kilos. (*i. e.*, that quantity of glacial acetic acid may be obtained); tar, 10 kilos.; water, 35 kilos.; and a residue of charcoal, weighing 22 kilos. Dry wood, submitted to distillation at 700°, yields, among other products, an oil which, like paraffine oil, can be used in lamps; it boils at 90°, and is devoid of smell. The author has also tried, as yet only on a small scale, to submit chopped-up wood to distillation in water containing 10 per cent of sulphuric acid; the result is the formation of acetic acid very abundantly, and of a peculiar aromatic principle insoluble in cold water.—*Les Mondes.*

114. Nature of the Sea-Water Along the Coast of Sweden.—Ekman.—As regards the quantity of salt contained in the sea-water on the coast of Sweden, there is greater difference than for any other now known sea. The coast alluded to is, on the one hand, watered by the North Sea, and on the other by the Baltic. In the more northerly part the water at the surface contains rather less than 2 per cent salt, at 60 feet depth 2·5 per cent, at 90 feet depth 3 per cent; in the more southerly portion the discrepancies are greater, but at 600 feet depth 3·5 per cent salt is met with. The average quantity of salt of the oceans is 3·44 per cent; while in the Atlantic, from the equator to from 55° to 60° N. latitude, the quantity of salt in the surface-water is 3 606 per cent, and at depths of from 500 to 10,000 feet 3·578.—*Berlin Chem. Society.*

[The per centages here given must include the *whole* saline ingredients of the water, for the percentage of pure salt, or chloride of sodium in ocean water usually ranges between 2.70 and 2.75.—Ed.]

115. Combustion of Metals.—Ditte.—Magnesium burns with dazzling brilliancy, the combustion of zinc is energetic, that of Indium difficult, and Cadmium melts and oxidizes with a flame scarcely visible; heat and volatility decrease in the same order. Similar analogies are observed in the reduction of the oxides of the four metals, in the decomposition of steam, etc. The following table shows the striking parallelism of their different physical properties:

	Magnesium.	Zinc.	Indium.	Cadmium
Density	1·75	6.9	7.15	8.65
Equivalent	12	33	35.5	57
Specific heat	0.2333	0°0555	0.088 theory	00.567
Point or fusion	ab't 500°	about 400°	....	ab't 315°
Point of volatilization	" 1100°	1040°	red	860°
Heat of combustion	72,890	44,258	37,502	16,231
Color of the oxides	White	white, light yellow	deep yellow	orange or black.

116. Very Hard Cement.—Rev. F. Moigno.—Some repairs being required to the stone steps leading to a garden, the mason used Portland cement mixed with finely-divided cast and wrought-iron filings and broken up borings, instead of with sand. The result has been that the mass has become so hard as not to admit of being broken either with hammer or pickaxe.—*Les Mondes.*

117. Discovery of Coals in Norway.—Rev. F. Moigno.—In the island of Andoe, off the coast of the province of Nordland, borings have been executed which have led to the discovery of seven seams of coal, varying in thickness from 0·076 to 0·508 metre.—*Ibid.*

[Equivalent to 3 inches to two feet; rather a poor "look-out," so far as profitable working goes.—Ed.]

118. Melting of Lead Shot when Fired.—E. Hagenbach.—After referring to a former paper on this sucject, the author states that Dr. A. Socin had exhibited to him balls extracted from wounds caused in the late war, some of which balls exhibited signs of fusion, thereby leading to the inference that, on the impact of the balls with bones, a great deal of heat is generated.—*Chem. News.*

118. Chinese Varnish.—Dr. v. Scherzer.—Under the name of schioliao, the Chinese apply as varnish freshly defibrinated blood, mixed with powdered slaked lime, and a small quantity of alum, in the proportion of 3 parts of previously defibrinated fresh blood, 4 parts of lime, and a small quantity of powdered alum. The result is the formation of a glutinous yet fluid mass, which is ready for use at once, and especially used for rendering wood perfectly watertight, and hardening its surface. The author states that he has seen in China bags made of straw rendered so impervious for liquids by the application of this varnish as to serve for the transport of oil, while thin millboard painted with this varnish becomes as hard as wood.—*Ibid.*

[Fresh blood is *defibrinated* by "whipping" it, as in converting the white of an egg into "syllabub" for example. The fibrine is thus separated, and a liquid obtained very rich in albumen, like white of egg, though of course red. Either egg or blood albumen, as found in commerce, may doubtless be used to make this cement, which after all is nothing but the ancient recipe for mending porcelain, with white of egg and quicklime.—Ed.]

119. Peat and Coal-Dust Fuel.—On page 105, current volume of the American Artisan, we suggested the feasibility of combining coal-dust with peat in the production of compressed or artificial fuel. We now find that, only two or three weeks since, our idea was practically tested on the North River in the furnaces of the tug-boat "Schurz," with a fuel composed of 70 per cent. of peat, 20 of coal-dust, and the remaining 10 of rosin and coal-tar. These are compressed into bricks, and are stated to give a strong heat and to leave an inconsiderable residue of ashes. The experiment lasted about six hours, and consumed one and three-fourths tuns of the prepared fuel as against two tuns of coal, the estimated quantity of the latter that would have been required for the same work. Whether this gain of some 12 per cent as compared with anthracite will be substantiated by a continued experience remains to be seen, but that this method of utilizing coal-dust has at least theoretical advantages over most of the innumerable others that have been suggested can scarcely be denied.—*American Artisan.*

120. On one of the English rivers the sewage from the cities and factories is so terrible, that a Wakefield manufacturer produced to the English Commission on Sewerage the river's own testimony in the form of a memorandum written in what would pass as pale ink: "Dedicated without permission to the Local Board, Wakefield, this memorandum, written with water taken from the point of the junction between the river Calder and the town's sewer. Could the odor accompany this sheet also, it would add much to the interest of this memorandum."

[The following rather smart doggrel was the product of one of the many poetasters that appear to infest the British Association; at its last summer's meeting. This sort of vein appears to us supereminently silly, but "there are many men of many minds," as Mother Goose said, who knew mankind.—Ed.

A Tyndallic Ode.

I come from fields of fractured ice,
Whose wounds are cured by squeezing,
They melt and cool, but in a trice
Grow warm again by freezing;
Here in the frosty air the sprays
With fern-like hoar frost bristle,
Their liquid stars, their watery rays,
Shoot through the solid crystal.

I come from empyrean fires,
From microscopic spaces,
Where molecules with fierce desires
Shiver in hot embraces;
The atoms clash, the spectra flash,
Projected on the screen,
The double D, Magnesian b,
And Thallium's living green.

This crystal tube the electric ray
Shows optically clean,
Nor dust or cloud appear—but stay:
All has not yet been seen:
What gleams are these of heavenly blue,
What wondrous forms appearing?
What fish of cloud can this be, through
The vacuous spaces steering?

I light this sympathetic flame,
My slightest wish to answer,
I sing, it sweetly sings the same,
It dances with the dancer;
I whistle, shout, and clap my hands,
I hammer on the platform,
The flame bows down to my commands
In this form and in that form.

American Gas-Wells, or Fountains.

By Prof. Henry Wurtz.

[Read to the New York Society of Practical Engineering, at the Regular Meeting, November 15, 1871[

There may be some present to whom the facts I have to present will be far from familiar, so little notice has this subject hitherto received, even in the literature of Science. It is, nevertheless, a subject as old as the world, and one which, for many years I have believed, is to play in the world's history a part that will justify and reward all the study we may devote to it. To illustrate this assertion, I shall enter somewhat into past records, giving first one or two ancient and then some modern instances of Gas-Fountains, natural and artificial.

Inflammable gas has issued from the bowels of the Earth during the whole historical period, in a great number of districts. The gas-springs of the Appenines, and of the lagoons of Tuscany, are familiar examples. In Plutarch's Life of Alexander the Great, it is said that the conqueror found in the district of Ectabana, in Media, "a gulf of fire, which streamed continually as from an inexhaustible force." The perforated stone altar in the temple of Ægina, which burned constantly without attention or replenishing, probably owed this to the use of such a gas-spring by the priests. Other instances might be given, did we allow space. By the ancients, ignorant of geology and chemistry, these phenomena were naturally looked upon as preternatu-

ral, either as direct emanations from the flaming billows of Phlegethon, in the horrid realms of Pluto; or, with others, by reason of their inexhaustible and inextinguishable nature, these apparitions symbolized the eternal and immutable attributes of the Deity, and hence were worshipped as sacred things. The poet Moore, in Lalla Rookh, makes goodly use of this symbol:

"Though now forever past, the days,
When God was worshipped in the blaze;
Though fled the priests, the votaries gone,
Still did the mighty flame burn on,
Through chance and change, through good and ill,
Like its own God's eternal will,
Deep, constant, bright, unquenchable."

In more modern times, we have the aforesaid Tuscan lagoons, and those on the *Pietra Mala*, between Florence and Bologna. We have accounts from China, of streams of gas which issue from beds of bituminous coal or shale, which are associated with salt, at a place 30 miles from Pekin, where from time immemorial the gas has been utilized in saltworks attached, for evaporating the brine, being conveyed also in pipes for lighting houses and streets. In this, as in so many other inventions, it seems that this ancient people have been far in advance of our boasted civilization.

Near Adalia, in Anatolia, on the Eastern Mediterranean, we have accounts of great burning springs. Those of the island of Zante, occuring with petroleum, are well known, and are mentioned by Herodotus. Everybody has heard also of the Caspian region, in which these phenomena are so abundant.

The *fire-damps*, of deep coal mines, of whose deadly deeds we so often hear such harrowing accounts, are exactly the same thing. In this place, I may add, that next to the Chinese account, the earliest record of the utilization of natural gas, was in England, during the last century. Sir James Lowther, in 1773, described to the Royal Society a stream of inflammable gas from a Whitehaven coal mine, which blazed 6 feet high and 3 feet in diameter, with experiments on the same; and 30 years later, a Mr. Spedding, agent of the mines, lighted his office with this gas, and proposed to light the town of Whitehaven, but the magistrates became frightened and forbid it.

Passing over, for the present, the great number of similar cases elsewhere, let us come at once to our own country, in which such outward manifestations of inward pent-up power, are more frequent, on an equal space, than in any other civilized land. A few only, of the most celebrated localities, can be referred to.

As long ago as 1830, we have published accounts (in *Silliman's Journal*, and elsewhere) of the lighting of the town of Fredonia, in Chatauqua Co., N. Y., by the gas issuing naturally from the bed of a small stream. Westfield, on Lake Erie, some miles southwest from the former place, is said to be also lighted in the same way. The Burning Springs, on the Little Kanawha, in West Va., is one of the oldest and best known localities of the kind. About four years since, we received the following account of the results obtained from a well (sunk originally for petroleum) at this place:

"The well is 900 feet deep, four inch bore, with a two inch pipe leading from it, more than a mile long, supplying 28 boilers of 12 horse-power each, 50 stoves and many lights, beside those which spring from leaks along the line, in consequence of the great pressure. I am now writing before a brilliant light on the counter, an engine of one horse-power pumping water over the house, and the waste gas running two stoves. My gas is brought through one half and three quarter inch pipe and yet I am obliged to cut it off outside to produce the proper pressure. I believe the pressure is not less than 200 pounds to the square inch."

The salt works on the Big Kanawha are another example where, together with the brine, the wells emit gas enough for its evaporation.

During the height of the petroleum *furore*, some six or eight years since, holes were bored far and wide, almost at random; and several gas-wells were thus developed. Prominent among the discoveries thus made, were two, one in Knox Co., Ohio, and another in Ontario Co., New York, where wells were obtained of immense power and volume, which have been flowing, without flagging, since that time, and have contributed much to direct attention to the subject, and towards the commencement of a movement which I believe destined soon to become great, and to lead us to a new art of developing the gifts of Mother Nature, giving us a new control over matter and force, the realization of which will surpass even the wondrous history of our petroleum production.

Nearly two years since, I gave to the Lyceum of Natural History, of this city, an account of a visit to the Ontario Co. (West Bloomfield) well, and of a scientific examination thereof. This paper, together with more extended reports and discussions drawn up by me about the same time, was widely circulated, and I am informed that a company was organized to convey the gas to towns throughout that section, but have no special information of their operations. The flame from the five-inch bore-hole, 500 feet deep, was some 30 feet in height; and measurements of the flow of gas have been reported as high as five cubic feet per second, equal to 432,000 feet per day. My analyses showed 82½ vols. per cent. of marsh gas, and 10 per cent. of carbonic acid, with 3 per cent. of illuminating gases, proved by analysis to be probably of the olefine group. The illuminating power was found to be from 5 to 6 candles, and it was inferred that purification from carbonic acid would give a gas equal to that served out to us here in New York city. In heating power, I have calculated this daily flow to be equal to about 14 tons of anthracite, which, at say $6 per ton, amounts to the interest, at 6 per cent., on $511,000. This, up to the time of my visit, four years, and, for aught I know, up to the present time, six years, has run to waste. Fearful and wonderful tales were told me of the enormous pressures developed in this well by confinement; for example, that two men with sledges had driven into the upper end of the tube a carefully whittled plug of hard wood, as hard and fast as possible; but that scarce had they ceased driving when the plug was ejected, with a stupendous uproar, and shot up to a height whereto the eye of man reacheth not. This narrative I do not endorse, and it does not seem calculated to command conviction, though I *have* met one gentleman who had actually *seen the plug*. One thing is then certain, that it came down again, and did not become a new satellite to our planet.

The Ohio, Knox Co., wells have been several times described. I shall quote from Dr. Newberry (*Amer. Chemist*, for December, 1870), whose visit was made as early as June, 1866. He describes two wells in the valley of the Kokosing, bored 600 feet deep. Jets of salt water and gas intermixed were at first thrown out to a great height.

"The first of these two wells was bored during the winter and the water thrown out soon covered the derrick with ice, forming a kind of chimney sixty feet in height. Through this the water was thrown at intervals of about one minute, to double that height, or 120 feet. After, and with the water, came a great rush of gas, which continued until the pressure was relieved, when the water again began to accumulate and was again ejected. This series of phenomena has been repeated with unvarying regularity and undiminished force, for some months.

When the derrick was covered with ice, the gas escaping from the well was frequently ignited, and the effect, especially at night, of this fountain of mingled fire and water shooting up to the height of 120 feet through a great transparent and illuminated chimney, is said to have been indescribably magnificent.

In well No. 2, the gas chamber was opened on the 1st of March, but this well has been carefully cased and the water all shut off, so that the gas is permitted to escape without impediment. A pipe two inches in the clear is set in the well-head, and from this a constant stream of illuminating gas is now, and for three months has been, escaping with a sound audible some distance from the well.

"At the time of our visit nearly 100 feet of pipe was connected with the well, and thus, at a safe distance, the gas issuing from it was ignited. The effect, even in bright sunshine, was surprising. A jet of flame was formed 20 feet or more in length and as large as a hogshead. By fixing a stop cock on the pipe the gas was made to accumulate until, measured by a steam-gauge, the pressure amounted to 180 pounds to the square inch.

"This was as great a pressure as the gauge would indicate, but it is evident that the pressure below is much greater than that, as the weight of the column of water, 600 feet high, lifted by it is 262 pounds to the square inch. When liberated after confinement of a few minutes, and ignited, the gas formed a volume of flame as large as a house. At night an exhibition similar to that witnessed by us at mid-day is said to be wonderfully impressive, the gas illuminating the whole country like a conflagration.

"The gas from these wells seems to be pure, having no other smell than an agreeable one of naphtha, and has high illuminating qualities. Its volume is sufficient to light a large city, and, if differently situated, the value of the material thus wasted, for lighting or heating, would be greater than the product of the best oil-well known."

The "Burning Wells," of Venango Co., Pa., 15 miles southeasterly from Oil City. Here there are two wells, the first bored in 1866, 850 feet deep; the second in 1869, 960 feet deep, by J. B. Benton, close by the first. The flow from the second is greater than from the first, without diminishing the latter in any degree. The pressure in No. 2 is estimated at over 200 lbs per inch, and the gas runs a large steam engine for pumping oil out of the well, not indirectly by making steam, but by its own direct pressure passing through the cylinder, no boiler being required; the pressure kept up being equal to 60 lbs. of steam! It may afterwards be used for fuel.

The numerous gas wells that have been bored at Erie, Pa., we have heard much of through various channels. The pioneer well at this place, known as the Althoff, is stated to have been sunk nine years ago, and to be flowing as much as ever. The gas horizon is about 500 feet down. Wells cost about $1,500 each, and the gas from each is estimated equal to 200 horse-power under a boiler. Coal for steam purposes, at the water works, formerly costing $10 per day, is now substituted by gas from a well, one half of which only can be used, the rest going to waste. No smoke, no dust, no grate, no ashes, no clinkers, no fireman's labor, no time lost in kindling fires, no chimney-stack, are minor and subsidiary advantages. In Erie this gas is used also for heating dwellings, cooking, distilling petroleum, etc., etc. I would here introduce the proposition that it is not fair towards gaseous fuel to value it according to a comparison of its absolute calorific capacity, with that of coal; for with the latter there are many causes of inevitable waste which can be entirely avoided with gas. Theoretically, one ton of anthracite is equal to about 30,000 feet of marsh gas; but practically, it is not equal to more than 20,000 feet.

Near Painsville, Ohio, the gas was struck last year at 550 feet and still more copiously at 700 feet. There are now two wells flowing, of the latter depth. The volume is described as being "so great, it is estimated by good judges, that it would light the entire city of Cleveland. It comes up through the pipe from the great deep below, with a rush and a roar and a grandeur which one must witness to appreciate."

Accounts from Cleveland, a few months since, state that gas had been struck there at only 104 feet, when boring for water. It would seem to be marsh gas, without any illuminant constituents, since it "burns blue" and moreover is "without any perceptible odor," a truly dangerous characteristic, fortunately unusual with these gases.

From as far west as Fort Scott, Kansas, we have had descriptions of a well emitting 10,000 feet per day, "of good illuminating power," discovered in boring for coal.

Other accounts come from the State of Mississippi, from New Orleans, Detroit, etc.

One of the latest developments is that by the Buffalo Gas-Light Company, in February last, of which we have the following account:

"The first vein of gas was struck at a depth of 318 feet, and the gas fissures gave out their contents at nearly regular distances of 20 feet thereafter. At the depth of 630 feet the salt water was thrown out of the well with such violence as to show there was a very strong impelling force beneath it. The water was then pumped out and the well was tested, when the gas began to flow freely. The tube, a two-inch one, was put in and the flow has been regular from that time in quantity sufficient to furnish fuel for a large manufacturing establishment.

"At the gas house the natural gas did the work of the ordinary fuel for the furnaces, small quantities of coke being supplied in addition now and then."

Having now tried to convey, in the least space, as

adequate an idea as possible of the grandeur, as well as the practical importance, of the phenomena we are considering, so far as they have been developed in the past; it remains for us now to consider the far more important questions of the future development, to the highest attainable degree, by the application of science and art, of these treasures of Nature. The points to be considered are three, to each of which we might, I think, devote profitably the time into which, this evening, we must needs compress all three. These points are the *Geology*, the *Chemistry*, and the *Engineering* of gas wells.

1. Geology.

This subject is one upon which we have already some valuable light, though many obscure questions yet remain, to be cleared away as explorations advance. At the same time, the scientific consideration, even of our present developments, cannot fail to be of great service, in guiding our future work.

Upon this subject I had many consultations, some years since, with my friend Dr. R. P. Stevens (now at the Guayana gold fields in South America), whose familiarity with the geology of the eastern United States is minute. He believes the gas of the Bloomfield well comes from the Marcellus shale, which crops out some miles north of the place, dipping south. This shale is so black as often to have been mistaken for coal, and sometimes will even burn. This he stated to be the lowest or deepest gas-producing horizon he had knowledge of. The facts stated, however, of the Buffalo well, 630 feet deep, which must have been sunk in rocks of the Corniferous period (Upper Helderberg), below the Marcellus, seem clearly to indicate another productive horizon far below this, and even altogether below the Devonian; and, as at Buffalo the Lower Helderberg (the upper member of the Silurian), as well as the Oriskany (the lower member of the Devonian) are both absent; and the Salina rocks are there many hundred feet thick, it seems probable that this latter group produces the gas there. This consideration points to another belt of gas wells that may be opened across New York, further north than the geological latitude of the Bloomfield well. Without geological maps it is difficult to make this subject clear, and I can but sum up by stating the probability that across the State of New York, from east to west, at least three belts of gas wells will be obtained, and that special success will be dependent chiefly on the selection of points for boring, where the three gas-charged horizons, the Salina, Marcellus and Genesee, lie some 500 feet and upwards in depth. Nearer the outcrops, where the depth is less, the pressure must have been reduced by leakage from the said outcrops, in the shape of gas springs, which are so extremely common in this range of country. Still, there is no reason why, in many places where the spontaneous flow is sluggish, great volumes should not be obtained by the application of exhausters to tubed wells, such exhausters being operated, as I have further to propose, by Hugon Gas-engines supplied with a portion of the gas itself. Torpedoes, also, will no doubt find useful application in this connection.

The line of gas wells along the Lake Erie shore, I think must be, in all probability, fed from the Genesee shale, as the Hamilton (which intervenes between the Genesee and the Marcellus) is thought to be here some 500 feet thick, and, moreover, the Marcellus is known to thin out rapidly in this direction, being stated to be altogether absent in central Ohio. Still, it must be added that the Genesee, according to Hall, is but 25 feet thick in this region. In Ohio, in consequence of erosion upon the great Cincinnati anticlinal, the outcrop of the Genesee trends far to the south, and hence the Knox county wells may be in this same horizon. Dr. Stevens believes the Subcarboniferous also to be sometimes gas-producing, and that the Venango county gas wells were from Upper Devonian, or the Chemung and Portage, an opinion which I have since heard also from Dr. Newberry. In Canada, at Petrolia and elsewhere, according to Sterry Hunt, the chief gas and petroleum-bearing rocks belong to the Corniferous.

So that we have here, widely spread over the immense area of the Devonian and Silurian basin of the Great Lakes and the Mississippi Valley, no less than five, probably six, beds of rocks indicated, which, wherever lying deep enough, and thick and porous enough, will be found to pour out combustible gas when tapped, in the bountiful and apparently exhaustless way we have seen. I believe then that I am fully justified in the editorial dictum indulged by me long since, in the American Gas-Light Journal, that:

"It may be accepted with implicit confidence as a fact, that there are vast districts of country throughout the United States within which, by *judicious* exploration, an immense number of such fountains of natural gas may be developed; furnishing a fuel which *raises itself* out of the mine, and which may be made to transport itself, up hill and down dale, to any point required; independently of seasons and circumstances, miners' strikes and railroad monopolists to the contrary notwithstanding."

In another place, I have thrown out the remark, in reference to such sources of fuel, that "Gaseous Elasticity is a miner who never strikes for higher wages."

The above slight geological sketch is of course ridiculously inadequate to this subject, but is all I shall allow time for, and must now pass on to a short chemical discussion.

2. Chemistry.

Two prominent chemical points present themselves, one chiefly of scientific, and the other of practical interest; relating, the one to the mode of origin, and the other to the mode of purification, of the gas. To both I have given much thought, and to the latter much experiment and invention. This latter, however, I shall not enter upon. As to my views of the mode of formation of the gas that exists now in such enormous compression in these different strata; I ask first, what *is* this gas chemically? Always essentially, from whatever horizon obtained, it is *marsh gas*, that hydrocarbon of all others which contains the most hydrogen, and the least carbon; the compound which naturally and necessarily forms the final residue of the abstraction of carbon from organic matter by a powerful oxidizing agent; since in nature we scarce find elementary hydrogen as such a residue. Now what oxidizing agents are there, or rather, what have there been, in all these rocks, that could effect such a combustion? I reply, *oxides of iron*, now represented in these rocks by iron sulphides, showing the iron oxides to have passed through the forms of sulphates. I again ask; What analogous action have we *now* going on everywhere on the present surface of the earth? The evolution of marsh gas from the black mud of a stagnant pool, loaded with vegetable matter, and blackened by sulphide of iron, which is occupied in conveying the oxygen of the water to the carbon of the mud. Every boy who has thrust a stick into such mud, bringing up a stream of marsh gas bubbles, has opened a gas well on a small scale.

This view of Gas-Genesis is but a corollary of my theory of Coal-Genesis, laid before the New York Lyceum, Jan. 10, 1870, which makes the oxidating action of ferrous sulphate on carbon the cause of formation of coal, together with its accompanying iron minerals. It will be remembered that coal and marsh gas are usually concomitant, in depth at least.

At the epochs of deposition of these rocks then, the basin of the great North American continental lagoon was filled to varying depths with ferruginous mud, highly charged with organic matter, which (after being covered with other beds of sandy character) during the process of induration into shales (a process without doubt due to the same action) underwent an internal fermentation, such as I have described. The carbonic acid always formed at the same time chiefly disappears, from its solubility in water, through which it is transferred to the bases, lime, magnesia and ferrous oxide, always abundant in such rocks.

3. Engineering Points.

The remaining points I have to deal with are the dynamical ones, involving engineering considerations. These also must be dismissed much more briefly than seems desirable, in a discussion before this Society, for which it is to be supposed they must carry the most interest. In the handling of these gases, ordinary engineering, even ordinary gas-engineering practice, will not furnish rules of much value. The enormous pressures to be dealt with, pressures moreover of a medium which is so subtile, will require special appliances and contrivances. Probably with regard to these it is not becoming to me, belonging to a different profession, to offer anything more than mere suggestion, and I shall therefore be satisfied with pointing out here what appears to me a new and inviting field for the scientific engineer.

After the gas has been controlled and confined, other engineering problems come in; inasmuch as many of these wells will be so situated that it will be highly desirable to convey the gas to long distances through suitable ducts. It will be, in fact is now, a problem to be determined by experiment, as to proper relations of length and diameter of duct, to such heavy pressures. For pressures of a few inches of water, all that is usually dealt with in gas engineering, an empirical formula has been arrived at, and is in common use, which is regarded as satisfactory, but, when we come to pressures of hundreds of feet of water, such as we must have in some of these well holes, I do not believe it has any reliability. Other problems relate to the best places at which to bore, in view of the varying contour of the surface, to reach the gas horizons with least work. These are problems which must be solved *jointly* by the engineer and the geologist.

It may not be without interest to attempt some calculations as to the amount of gas that can be relied upon in the future from this source. The gas has been known to expel columns of water more than 700 feet in height. It would be fair then to admit the existence of tensions of compression, of twenty atmospheres. If the porosity of the rock is only five per cent. of its volume, the whole gas would then assume at the surface the volume of the rock itself. Then if the three New York belts are 200 miles long and equal in mass to 10 miles wide of 100 feet thickness (a moderate allowance) they will supply more than 3000 wells like the Bloomfield, for over 100 years. These figures, though stupendous, do not amount to practical inexhaustibility, and I suggest that legislative action ought to be taken in the gas-producing States, to prevent waste of this precious natural product. It may be objected that no man can be prevented from boring any holes he chooses on his own farm, and from leaving them *uncorked* afterwards; but it appears to me, on the contrary, that the same principle ought to apply here as in the case of streams of water on the surface, which no man could legally, or with impunity, divert from his neighbor's property, and cause to run to mere waste.

In conclusion, gentlemen, I will venture to enounce, as my own conviction, which (however visionary it may be deemed by many, I claim to be strictly founded on induction from known facts), that throughout large sections of the United States (throughout the middle tier of counties in western New York, for example), every town, nay, every house in the land, ought to be both warmed and lighted by gas drawn from the bountiful bosom of Mother Earth, without money and without price.

Report to the Board of Trade by the Gas Referees on the Ammonia Impurity in Gas.

[Condensed by Editor of this Journal.]

[Concluded from page 148.]

II. The Scrubbers.

The size of the scrubbers is almost as imperfect a criterion of efficiency as is the volume of the condensing surface. In comparing one kind of scrubber with another, to determine their efficiency, the real points to be regarded are the size and cost of the scrubber; and the cost of all the ordinary kinds of scrubbers (that is, those filled with coke or brick) corresponds very nearly with their size; so that their size or cubical volume, taken in connection with the results produced, is the true criterion of their efficiency as purifying apparatus. The scrubber filled with thin deal boards costs about a third more than the coke or brick scrubbers; this kind of scrubber is employed at the South Metropolitan Works, and partially at the Bow and Haggerston Works of the Chartered and Imperial Companies.

The cubical volume of the wet scrubbers (including the space occupied by the apparatus for distributing the water) at the several gas-works, per 1,000 feet of gas, reckoned upon the average hourly make, is as follows:

Beckton, 678.5 cubic feet; Westminster, 145.9 cubic feet; Brick Lane, 165.5 cubic feet; Curtain Road, 160.4 cubic feet; Blackfriars, 212 cubic feet; Bow, 106 cubic feet; Fulham, 26.6 cubic feet; St. Pancras, 64.9 cubic feet; Haggerston, 130 cubic feet; Old Kent Road, 264 cubic feet.

III. Supplementary Appliances.

The supplementary process of ammonia purification, viz, by the use of sulphate of iron, or sulphuric acid and sawdust, are, generally speaking, largest in those works where the scrubbing power is least. At those works where used, the volume of this purifying material, for each 1000 feet of gas, reckoned upon the average hourly make, has been as follows:

Per 1000 feet	B. Lane.	W'ster.	Fulham.	St. Panc.	Haggers'n.
Sulph. iron..	20·3 c. f.	26 c. ft.	None.	37·2 c. f.	14 cu. ft.
Sulph. acid and sawdust ...	None.	None.	6·04 c. f.	None.	None.

IV. Summary.

In the subjoined table, as the ammonia-purification is most perfect at the Blackfriars Works (the gas supplied from those works being totally free from ammonia), they are here taken as the unit of comparison; the supplementary appliances being as under III.

	Cond. Surface.	Area of Scrubbers.	Ammonia in Gas pr 100 f.	
Blackfriars	1·0	1·0	None.	Av. 6 mos.
Westminster.....	·76	·69	3·02	
Brick Lane.....	·79	·78	2·05	
Curtain Roap....	·65	·75	2·2	
Bow	·80	·5	·44	
Beckton	1·53	3·2	None.	
Fulham.....	·58	·12	·48	Av. 6 mos.
St. Pancras.....	1·2	·12	1·8	
Haggerston.....	·57	·61	1·4	
Old Kent Road..	1·1	1·24	·82	

One great advantage from the establishment of a Board like that of the Referees is, that having full powers to inspect the various gas-works, they are in a position to do what has never been done before; namely, to examine minutely every stage in the work of Purification, comparing one gas-work with another, thereby correctly ascertaining the highest degree of purity which can practically be attained in gas as supplied to the public, and also furnishing each gas company with valuable (and hitherto unattainable) information of what is being done in the works of other companies.

The referees are making a series of experiments upon the amount of ammonia in the gas, both at the inlet and outlet of the several scrubbers in each gas-work under their supervision, in order that the efficiency of each kind of scrubber may be fully and practically demonstrated. When the experiments are completed, the results will be duly reported to the Board of Trade, by which time also the working of the reduction in the maximum for the ammonia-impurity will be ascertained.

Construction of Scrubbers.

If all scrubbers were identical in construction, the results of purification would correspond with the size. But, as the records show, such is not the case; even the cubical volume of the scrubbing material being an inadequate criterion of the purifying power; and the causes of the differences may be summarized thus:

1st, the kind of material with which the scrubbers are filled; 2nd, the arrangement of that material; 3rd, the quantity of water; 4th, the manner in which the water is distributed; and, 5th, whether the ammoniacal liquor is returned into the scrubbers.

Firstly, as to the scrubbing material and its arrangement;

1st. The ordinary scrubber, in which the interior of the apparatus is filled with coke or brick in a continuous mass from top to bottom. 2nd. The scrubber (like Mr. Mann's) where the coke is arranged in several tiers or compartments with an open space between each, where the gas distributes itself anew through the purifying material. 3rd. The Livesey scrubber, where thin deal boards are used, set on edge and arranged in several tiers, the boards of each tier being set so as to slightly cross those of the tier immediately above and below it. 4th. Where wooden shelves covered with water are used, as in two of the scrubbers at the Fulham works.

Secondly, as to the water supply.

The apparatus generally employed consists of several tubes radiating from the centre of the circumference, and pierced with holes from which the water is distributed in jets upon the mass of coke or other scrubbing material beneath, the holes usually increasing in number as they approach the circumference, where a larger area of material has to be wetted. In order to minimize the supply, Mr. Mann uses three tubes open only at the ends, from which the water trickles in a very fine stream, each tube revolving on a fixed centre.

Whether the distributing tubes are fixed or revolving, the water from the holes or jets necessarily falls always upon certain spots—the other parts of the surface of scrubbing material remaining comparatively unwetted; although, doubtless, the water soon distributes itself more equably as it descends through the scrubber. To remedy this, Mr. Mann interposes between the distributing tubes and the underlying coke a "birch-wheel," or revolving thick layer of birchwood twigs, lessening in depth towards the circumference, through which the water trickles slowly and equally at all points. The uppermost part of Mr. Mann's scrubber, also, containing the apparatus for water distribution, is made a few inches wider than the rest, in order to secure that the sides of the scrubber are well wetted, as the gas usually ascends more freely by the sides than up through the interio; mass of scrubbing material

When new scrubbers are erected, or when old ones are remodelled, the form now being adopted is either that of the Mann or of the Livesey scrubber.

The Livesey scrubber, used by the South Metropolitan Company, at the old Kent road, was devised mainly in order to avoid the choking or fouling which occurs with coke or brick scrubbers by tar, which creates an inconvenient amount of "back-pressure," and also necessitates a change of the scrubbing material. Judged from this point of view, the Livesey scrubber has been a success; for it gives no back-pressure (in other words, the gas encounters no resistance at all in passing through it), and apparently it will last for an almost indefinite time without any change of the material with which it is filled. It is found that the deal boards, though constantly wet, show no tendency to rot—a result doubtless due to the antiseptic influence of the tar. The open area or interstitial spaces in this scrubber, as used at the Old Kent Road (where the boards are set on the average about ¾ inch apart) are on the average three times greater than the area of the pipes which lead into and out of it; and as these spaces are not liable to be choked up, it follows that the gas can encounter no resistance in passing through, so that no back pressure is produced. The weak point of this scrubber is that it cannot eliminate the tarry vapor from the gas so well as the coke scrubber; accordingly, where this kind of scrubber is used, the previous work of condensing the gas ought to be carefully attended to.

In some works the boards are set closer than in the scrubber used by Mr. Livesey himself, and doubtless this is an advantage as regards purifying power; but it cannot yet be determined whether this advantage may not be counterbalanced by the greater tendency to foul—thereby producing back pressure, and also necessitating a more frequent change of the scrubbing boards, which in this scrubber is an expensive process.

A scrubber of this kind, we believe, was first adopted at the Haggerston works of the Imperial Company, where another scrubber is being erected of a similar kind, fitted with the excellent apparatus for water distribution employed by Mr. Mann.

The Mann scrubber at present holds the first rank as regards efficiency, and perhaps also economy. Its first cost is considerably less than that of the Livesey scrubber; and although its contents require to be changed more frequently than those of the Livesey scrubber, yet as its coke has to be changed only once in three years, and as the cost of this is very trifling compared with that of renewing the woodwork in the Livesey scrubber, the cost of construction and maintenance may be stated on the whole as in favor of the Mann scrubber. The special advantage of the Livesey scrubber, as already said, is, that it gives no back-pressure, thereby lightening the work of the exhausters, which is equivalent to a saving of fuel. On the other hand, Mr. Mann's scrubber, taken in connection with his condensing apparatus, at present gives the best results of any as a purifier, and is also the most simple and economical in its action, seeing that no pumping of the liquor back into it is required.

The strength of the ammoniacal liquor obtained from this scrubber is much greater than from any other. In nearly all gas-works the liquor has to be passed several times through the scrubber before it acquires the requisite commercial strength of "10 ounces;" whereas the Mann scrubber yields fully "14 ounce" liquor, so that it can be mixed with the weaker (5 or 6 ounce) liquor obtained from the condensers, and yet remain fully up to the strength required of it as a saleable commodity, and this by being passed merely once through a single scrubber. The usual practice is to pass the whole of the gas through all the scrubbers in succession; each scrubber, of course, yielding a different strength of ammoniacal liquor according to its position in the series; whereas Mr. Mann distributes the gas in equal quantities into each scrubber separately, and each scrubber of itself completes the work of purification, yielding liquor of the same strength.

Mr. Mann is at present endeavoring to perfect a self-acting process of water-distribution, by using an apparatus on the principle of the Barker's Mill, but with a means for preventing the choking of the holes, but, as it has not yet been adequately tested, the Referees cannot at present pronounce an opinion.

As it has been thought in some quarters that this scrubber attains its excellent results at the expense of of the illuminating power of the gas, the Referees made several experiments on different days to determine this point. As the result of several testings, they found there was no appreciable loss of illuminating power.

No injurious effect is produced except where water is employed in excess.

General Remarks and Suggestions.

An adequate condensation is, as we have shown, a matter of importance as regards ammonia-purification: for, if the gas is not properly cooled before entering the scrubbers, the absorbent power of the water in these vessels is diminished; and if tarry vapor in large quantity is carried forward into the scrubbers, the scrubbing material (as sometimes happens) may be suddenly "fouled" to a degree which seriously affects the purifying action.

Underground pipes are very defective as condensers, but, as already said, they serve to keep the tar for a longer time than usual in contact with the gas. This object, so far as is at present known, appears worthy of attention in all gas-works, by devoting a considerble length of pipes (placed either underground or along the inner side of the walls of the retort-house) to this purpose. Thereafter the work of condensation proper may be carried on quickly and safely.

The referees consider that the best means of condensation is to be found in the "dry scrubbers" of Mr. Kirkham and the water-tank process used by Mr. Livesey. The latter process is capable of securing the condensation of the gas in little space and at a steady temperature, whatever be the variations in the external temperature or in the make of gas; and the former, the "dry Scrubbers," afford an unequalled means of facilitating the elimination of tar by *settling*, and also by bringing the tarry vapor into contact with surfaces which promote its deposit. A combination of these two processes would accomplish the work of condensation in a manner which would leave nothing to be desired.

The ordinary system of condensing the gas in pipes of uniform and small size is certainly defective; for, although the *cooling* of the gas may be adequately effected in such pipes, they offer no facility for the mechanical settling or deposit of the tar. Accordingly, the Referees consider that, whatever be the method employed for cooling the gas, large chambers ought to be introduced in the condensing pipes, wherein the velocity of the gas-stream is reduced, so that the tar may settle down—instead of being carried on, mechanically suspended, in the rapid current; and if those chambers can conveniently be filled with coke or other substance promoting a deposit of tar on its surfaces (as in Mr. Kirkham's "dry scrubbers") the condensing process will be still more efficient.

In the majority of gas-works, the work of condensation is at present carried on by pipes or vessels in the open air; and it appears to the referees that means might be adopted to lessen the untoward effects of the great vicissitudes of temperature to which such open-air condensers are exposed. The effect of these vicissitudes upon the temperature of the gas is very powerful. For example, after a summer shower, following hot sunshine, a gas-holder of ordinary size will fall to the extent of six feet, and it will rise to an almost equal extent when a cloudy morning suddenly gives place to brilliant sunshine; from which facts it appears that these vicissitudes at times raise or lower the temperature of the gas to the extent of about 30 degrees. The same influences, of course, operate upon all the open-air pipes and purifying apparatus in gas-works. Indeed, the referees have observed that even in the scrubbers a sunny day occasionally raises the gas several degrees above the temperature at which it enters them, thereby diminishing the purifying power of the apparatus. They, therefore, suggest that it would be advantageous to protect the condensers, and indeed the scrubbers also, by a covering of some kind,* which, however slight, would greatly neutralize the vicissitudes of temperature which are so striking a characteristic of our climate, and thereby allow of the operations being carried on at a steady temperature, such as the engineers in the several works may find most suitable to the efficiency of their apparatus.

Some of the scrubbers at present in use in the London gas-works might be considerably improved as purifying apparatus by the adoption of a more perfect made of water-distribution. The referees also consider that in every coke or brick scrubber the material ought to be arranged not in a continuous mass, as is usually the case, but in separate tiers, varying in number with the height of the scrubber; each tier being about eight feet in depth, with an open space not less than half a foot in depth between each tier, and also with a movable plate at each open space, by the removal of which the action of the water-distribution and the general condition of the scrubber can from time to time be observed. The advantages of such an arrangement are, 1st.: That in these open spaces, the ascending gas redistributes itself, instead of forcing a passage upwards through a few routes from bottom to top, as it always tends to do in proportion as the scrubber becomes foul with tar; and, 2nd, by observ-

* Such protection is afforded to some extent wh re Mr. Mann's "birch-wheel" is used, which covers the to of the scrubber.

ing the drip of the water in those open spaces, the efficiency of the water-distribution could be ascertained at the outset, and the general condition of the scrubber inspected at all times, instead of remaining unknown and inscrutable, as is the case in ordinary scrubbers, the condition of which is only judged of at present by the amount of "back pressure" which they give, which is a most inadequate criterion of the condition of the scrubber.

As already stated, the referees regard it as economically advantageous that in all gas-works the ammonia should be removed wholly by means of scrubbers, not only because this would save labor (required for changing the trays of sulphate of iron and the sulphuric acid purifiers), but also because the ammonia yields a better return in the form of ammoniacal liquor, as obtained from the scrubbers, than when the above-described "supplementary" process of ammonia-purification are employed. The full details which the companies possess of their receipts and expenditures will doubtless convince them that it is advantageous to do the work of ammonia-purification wholly by means of scrubbers.

CONCLUSION.

The order of the referees, by which the maximum allowed for the ammonia-impurity is to be reduced one-half after the 30th of September, is fully in accordance with the above remarks; for it gives the companies ample time to make the requisite changes in their apparatus for ammonia-purification, and imposes upon them no outlay but such as they are imperatively called upon to undertake in the interests of the public. The referees have given six months' notice to the companies of their intentions in regard to the ammonia-maximum. With the fact before them that the Mann scrubber entirely purifies the gas from ammonia, the referees cannot permanently allow of any inferior result of purification in any of the gas-works under their supervision.

T. FOSTER,
Secretary.

Correspondence.

[Correspondents, in all cases, should sign their communications with their names and address in full—not necessarily for publication, but as a guarantee of good faith.—EDS.

Wet and Dry Gas Meters.

TIFFIN, OHIO, November 13, 1871.

Mr. Editor: I am, and doubtless others will be, fully satisfied with the reasons you have given (November 2) for the publication of Mr. Keeling's scribblings, and gratefully acknowledge the favor you have promised me, of giving my letters in full; and should I say aught to deserve it, I expect to be condemned by your readers, and to be berated as soundly as Mr. Keeling has been by three or more of your correspondents, who, I think, have given him his quietus; meanwhile it is better to talk of meters, and the difficulties that arise in relation thereto, rather than to talk further to Mr. K., although I do not intend to treat the meter as a machine to cheat with.

My preference is, and always has been for the wet meter, and now that we have glycerine to fill them with, and State Inspectors to reject the faulty, they seem to me to be all that can be desired; the line of difference between the top of the "syphon" or "dry well," and the side screw or "water level," is only sufficient to prevent the overflow of the syphon (and consequent putting out of lights) by the sudden agitation of the water when the gas is turned on, and for some evaporation of water without closing the valve through which the gas is introduced.

The great advantage of the wet meter is that the gas is measured in a non-elastic "drum" or chamber, that is not affected by pressure or temperature, and is more durable; not that I have anything to say *against* the "dry" meter, which is also a beautiful machine, and is proved to be a fair measure between buyer and seller.

The question will probably arise—Why have the wet meters been abandoned? They have been nearly superseded by the dry meter, because in winter the water would freeze, and to obviate this, alcohol was introduced with the water; this was an item of expense, and was of only temporary benefit, as the volatile part was soon absorbed by the gas, and the reduction of quantity made the action very uncertain, etc.; but the use of glycerine overcomes all these troubles, evaporation included.

I will for the present leave this branch of the subject, and state what I believe to be the main cause of trouble in relation to meters, viz., the *wilful ignorance* of the consumer as to taking the register.

My experience has been uniformly this, when the consumer will take his own register, all serious doubts give way. I had one who told the inspector, monthly, what his consumption was; and it was necessary to go into his cellar once or twice a year to verify his statement, which was usually correct; he had been one of the most intractable.

"Oh but we cannot understand it," say some. Yes, sir, you can, by ten or fifteen minutes study of the diagram on the back of the gas bills (Manhattan Company), or if that is not readily understood, you can surely follow this instruction: Go to your meter before the Inspector, and on a piece of paper write down the figure last *passed* on the *left hand* dial, then the next same way, then the next, and add to the last two ciphers, and you have the number of feet recorded, less the fractions of a hundred, which are generally left, and make a part of the next bill; preserve the paper and see that your bill corresponds, and when you repeat the operation next month, the lesser (last taken) being subtracted, gives the gas used in the interim. The diagram here inserted indicates 81,125, but would be taken 81,100, leaving the 25 feet, as mentioned.

Not only will this give the consumer security for the future, but if, on examination, it is found that the present condition of the index corresponds with the gas bill last rendered, he is at once assured that there has been no fraud in the past.

In regard to the meter possibly registering too fast, I reassert that a burner of a given size, burned for an hour, will give an *approximate* test.

Yours respectfully,
MACHINIST.

Water Supply.

[Dr. Letheby, in a recent lecture cites the following conclusions of recent investigations on the sanitary points connected with water supply—ED.]

1. The human body needs for its structure and maintenance the supply of certain salts, among which are the carbonate and phosphate of lime, these being in a special manner required to give stability to the bones, but having also their further uses in the living economy.

2. The phosphate of lime is supplied to us in our ordinary animal and vegetable food, but is not presented to us in water.

3. The carbonate of lime, on the contrary, is not primarily presented to us in sufficient quantity in our solid food, but is contained in variable and more fitting proportions in spring and river waters.

4. It is from the carbonate of lime brought down by rivers into the sea that all marine animals derive the denser parts of their construction, the remains of which, during the progress of geological periods, have been, and continue to be aggregated into huge expanses of limestone rock.

5. What has sufficed for the wants of these lower animals has sufficed also for those of the higher organizations, of which man is the head.

6. Positively, this is proved and confirmed by the fact that it is in the limestone districts, where the waters are more or less hard, that man has been shown to have reached his most vigorous average physical development.

7. Negatively, this is proved also by its having been found that the mortality of our principal towns increases, on a calculation of averages, in the proportion that the hardness of the waters is diminished.

8. A water containing about six grains of carbonate of lime is nowhere held to be a hard water, but is fitted for every use of domestic economy or manufacture.

9. Such a water, whether as a drink or as combined with our food, presents to us, in the most regular and constant of forms, and in its most simple, natural, and easily-appropriated state, the carbonate of lime required for the healthy maintenance of the living system; while it is otherwise naturally preferable, because imbued with more agreeable qualities, and with higher refreshing and invigorating powers.

10. A lake water, independent of the consideration of its low impregnation with carbonate of lime, is further objectionable from its deficiency of air and carbonic acid, its extreme coldnes in winter and tepidness in summer, its combinaton with peaty and other matters, the abundant presence of living animal and vegetable organisms, and its general want of sapidity and agreeableness, and, consequently, its lower refreshing powers.

11. These views, so obviously concordant in fact and reason, are consistent with the natural tastes and instincts of all peoples in all ages, have been maintained by the mass of scientific men in all countries, and have been publicly ratified through the results of repeated Government inquiries.

12. Therefore, wherever a community has a choice between a water immediately derived from springs, and thus moderately impregnated with carbonate of lime, the excellence of which no one questions, and a lake water, the defective qualities of which are denounced by many, it ought unquestionably to prefer the former, on every probable consideration of comfort, health, convenience, and, in the end, were it on no other grounds than these, of the truest economy.—*Lond. Jour. of Gas-Lighting.*

RECENT AMERICAN PATENTS.

Pertaining to the Specialties of this Journal, for the three weeks ending November 25, 1871.

120,376.—Regulator.—W. L. Gebby, New Richland, Ohio.
120,388.—Lamp Burner.—T, Hipwell, Camden, N. J.
120,409.—Gas.—W. C. and G. W. Wren, Brooklyn, N. Y.
120,475.—Lighting Gas.—J. Vansant, San Francisco, Cal.
120,550.—Gas Apparatus.—G. Lowden, Brooklyn, N. Y.
120,715.—Gas Burner.—T. Clough, New York city.
120,761.—Water Ram.—F. Miller, Pittsburgh, Pa.
120,824.—Gas Machine.—W. T. McMillen, Richmond, Ind.
120,853.—Water Meter.—C. Campeaux, New York city.
120,882.—Gas Burner.—W. Jones, Chelsea, Mass.
120,587.—Liquefying Gas.—W. F., W. A. Johnston, Brooklyn, New York. (2 patents.)

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Prof. HENRY WURTZ, Editor Chemical Department GAS-LIGHT JOURNAL.
HENRY J. DAVISON, Engineer, 77 Liberty Street, N. Y.
HERRING & FLOYD, Oregon Iron Foundry, 738 Greenwich Street, N. Y.
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Col. WHITE, Engineer People's Gas-Light Company, Williamsburgh, N. Y.
GEORGE W. PARSONS, Sup't and Eng'r, Rochester Gas-Light Co., Rochester, N. Y.
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J. H. GAUTIER & Co., Fire Brick Works, Jersey City, N. J.
Professor SILLIMAN, New Haven, Conn.
JOHN HARRISON, Engineer People's Gas-Light Company, Baltimore, Md.
CHARLES FABEN, Superintendent and Engineer Toledo Gas-Light Co., Toledo, O.
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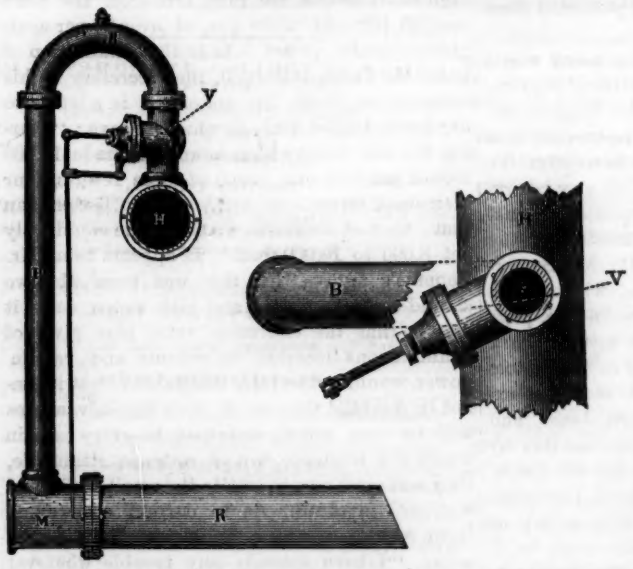

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☞ All communications to be addressed to "THE EDITOR, No. 42 Pine Street, Room 18, New York.

SATURDAY, DECEMBER 2, 1871.

WISHING TO MAKE THIS JOURNAL an organ of intelligent discussion to those of our readers who may wish to gain or give information on the subjects to which its columns are devoted, the publishers solicit letters from all among them who make the study of these subjects a pleasure, or a profession.

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General Editorials.

COOMBS'S IMPROVEMENT IN STAND-PIPES.

We have at last the pleasure of presenting to our readers, this week, a description, with an illustration, of what we regard as one of the most important improvements in the economy of Gas Works that has yet originated in America. Its history is as follows: Moses Coombs, Jr., the skilful engineer of the gas works at Youngstown, Ohio, had for a long time been aware, from his own practical observation, of the principle that to get the best results, both in quantity and quality, from a bench of clays, the very highest working heats should be obtained and maintained; as well as of the main objection to such high heats, that the tendency to the choking of the stand-pipes was so great as to become an almost insuperable obstacle. He has therefore sought for a practical and reliable mode of preventing such obstruction, so that the best heats can be continually kept up, thus increasing the amount of candle-power attainable from each retort, *in the same time*, very greatly.

For some two years past Mr. Coombs has been experimenting with arrangements for keeping down the heat of the stand-pipes, and having become convinced by a long series of actual working results, of the correctness of his principle, requested us to procure for him a patent for the same; and he now presents it in perfected form to the gas community.

It is unnecessary for us to spend many words in setting forth, at least to our practical readers, the annoyances, the difficulties, the dangers and the delays which arise when stand-pipes get into a fashion of becoming clogged, as is so often the case since the wide introduction of clay retorts and high heats. In a highly important discussion of this subject at the last meeting of the British Gas Managers, June 1871, Mr. Somerville, of the great Dublin Works, who makes, according to Prof. Chandler (this volume, page 134), four millions of gas per day, says: "They are a constant source of anxiety in the retort house, as they are also a constant source of expense and waste." Mr. Hodgson Jones and others claiming that they had overcome this by using very large ascension pipes, Mr. G. Anderson rejoined that this made no great difference. "He had had seven inch pipes stop as well as four inch," and "whatever the size might be, it was simply a question of a longer or shorter *time* before the pipes became stopped." Under favorable circumstances he had, though with misgiving, used three inch pipes, but found them perfectly efficient, which "confirmed his belief that it was not a question of size at all, but of heats." This matter has by no means escaped the attention of other gas men in our country, and we are ourselves aware of several other plans now being tested with this object in view. These must stand on their own merits; at present we are concerned but with the simple and perfected plan of Mr. Coombs, which we are assured most positively has accomplished, and is now constantly accomplishing, the most gratifying success in this direction.

Before leaving the discussion of the British Gas Managers, we must quote some further passages of great interest in the present connection. Mr. Somerville said that some practiced charging those retorts liable to stoppage every four, instead of every six hours, this being "the best method of robbing the retort of its excess of heat." Also that

"Some method of keeping the pipes cool, as the whole source of the evil under consideration is hot pipes, becomes the paramount desiedratum in preventing the nuisance.

"To prevent the radiation of heat from the brick work of the bench, the transmission of heat from the iron mouthpiece, and the prevention of the flame acting upon the pipe during the time af drawing and charging, are the three means to be employed for prevention and cure."

Further; that

"Doubtless, if ascension-pipes were cast double, or having a jacket surrounding them with a constant circulation of water or air from top to bottom, stopped pipes would be unknown."

We quote so much, to illustrate two remarkable facts; first, that Mr. Coombs had arrived two years since at a perfect appreciation of the principles involved in this matter, which were only publicly discussed as late as last June, as the latest conclusions of the most skilful engineers in Great Britain; and second that the crude suggestion thrown out in the last quoted sentence had been closely anticipated in actual working by Mr. Coombs long previous. (We may add that by a coincidence, the day of convening of the British Managers June 13, was also the very date of a letter to us from Mr. Coombs enclosing his complete specification and drawings).

It is not our present intention, in this introductory article, to enter much into details of results, as we shall return to the subject very soon again; but will say that in addition to the advantage of doubling the volume of gas with the same time and labor, Mr. Coombs claims that the very high heats he can use give him from the same coal 20 per cent. more gas, of over 20 per cent. greater candle power. As to the diminution of time, Mr. George Cornell, the Secretary of his company, confirms his statement in a letter to us, dated August 10th, in which he says: "During the last twenty-four hours he made 18,000 feet of gas with one bench of three retorts, four inch stand pipes, and says he can do better than that * * * whereas without it he could only get 8,000 to 10,000 feet." It appears from Mr. Coombs's figures that this was from what we should call a poor coal, and with richer coals it may be that the enormous ratio here given of simultaneous increase in volume and candle power, would not be fully maintained; but it cannot be doubted that in all cases the advantages will be very great; and that in every case in which the requisite flow of water is attainable, they will most amply justify the small additional expenses involved. As to current cost (apart from cost, if anything, of water) Mr. Coombs says; "I have scarcely any trouble whatever in working with my invention. It is verysimple. In fact, you might say that when you start it, it will takecare of itself."

ANOTHER GAS WAR BEGINNING.

The *New York Times* has dug up the hatchet, and is industriously engaged in fomenting the always smouldering animosity of the consumers of gas towards the producers. The main difficulty this time seems to be in the great up-town Metropolitan Company's district (34th to 79th street), which is probably now increasing in population and gas-consumption, more rapidly than any other equal part of the earth's surface. It is no wonder then that some difficulties, delays, and even impossibilities, should be found in keeping up sufficiency and uniformity of volume and pressure. As to the *details* of the difficulties, however, we have not ourselves the slightest information about them, or of aught except what all the world knows from the newspapers. If we had, there would be no room in this issue for their discussion, however. We may give some

space to the subject in our next. Here we shall but say that our panacea for all these ills is still the same, the one for which we personally strove so hard and long during the legislative session of 1868-9, without other reward than some private obloquy; namely, the institution of a Board of Chemists, to keep up continual tests and analyses. We are ready again to do what we may to forward this. The *Times* says:

"Nothing short of a standing court of the people for the hearing and following up of popular complaints will ever be sufficient."

A correspondent of the same sheet says also:

"What the gas consumer needs for his protection, is a daily analysis of the gas and records of the hourly pressure under which it is furnished, and of its illuminating dower as determined by photometric processes. These records in like manner as those of the Signal Bureau, should be published in the daily papers."

All this was almost identically embodied in the bill brought up at the said session, creating a Board of Gas Examiners, based chiefly on suggestions of the present writer, and which passed the Assembly almost unanimously, but failed unexpectedly in the Senate. The unwisdom of this failure, we think, should now be apparent, to the companies as well as the public. What this Journal wants, as we so often reiterate, is justice to *both* producer and consumer, and some means of ensuring it, notwithstanding that the City press ss persists in viewing us as *the organ of the City gas companies!* If our words ever reach these people, it may surprise them to hear that outside of the sale to said companies, by annual subscription, of this Journal (which is to *their* benefit), the latter has no connection whatever, of a business kind, with said companies. Even our advertising patronage is entirely outside of them. Why then should we be their organ?

LATER.—Since the above was written, the *Times* would appear to be toning down somewhat. We read:

"In certain instances the fault has been due to the ignorance, carelessness or neglect of the complainants themselves. It must be remembered that very few of our million of inhabitants have the slightest knowledge of the nature of gas, and how the meters, fixtures, and pipes should be looked after."

Let them take to reading this Journal then.

AMERICAN CANNELS FOR DOMESTIC USE.

Since we made our analytical examinations of the "Sterling Cannel Coal" (sold in this city by the agent, Mr. George Merryweather, of 5½ Pine street) with a view to its adaptability for gas purposes, which gave such remarkable and favorable results (see issue of October 2), we have had—we may say, we have enjoyed—a most ample opportunity to test the qualities of this material for another use, that is, in an open grate in a sitting room, in which we have had it blazing away now almost constantly night and day, for about six weeks.

The result is again of the most favorable kind. In the open fire there is no caking whatever, as there is in the confined space of the gas retort. It cracks up gently into angular fragments, or rather flat plates, conformably with its highly slaty structure; but there is no snapping and flying, or explosive decrepitation whatever. The blaze is white and cheerful, in fact it resembles in its manner of burning, to a remarkable degree, a hard dry fire-wood, leaving, like this, after the blaze has gone, a mass of glowing brands, which radiate powerfully, for a long time, furnishing an admirable fire. One of its many advantages over anthracite is that there is *no waste* about it. Not a particle of carbonaceous matter is left among the ash, which latter are more voluminous than with most anthracites, though curiously enough they appear much heavier and more granular than anthracite ash, and consequently do not *fly*, like the latter. All housewives will highly appreciate this valuable characteristic. Its extreme inflammability makes a fire even easier to kindle than one of charcoal. Though very easy so to arrange a lump, as to smoulder slowly all night, and make a good fire at once when broken up in the morning, yet it has occasionally gone out through neglect; in which case we have found that a fire can easily be kindled again with a newspaper alone.

For office use there could be no pleasanter, more convenient or economical fuel; and we hear that it is being sold largely in this city for this purpose. We trust Mr. Tuttle, of Cleveland, and his agents, will persist, and be highly successful, in their praiseworthy efforts to confer upon this community what we truly believe will be a great public benefit, by introducing this new fuel copiously and cheaply.

WET METERS—GLYCERINE.

We rejoice that our explanations of November 2nd have appeased the ire of our valued correspondent "Machinist," and that his able and facile pen is again exercised for the behoof of the GAS-LIGHT JOURNAL and its readers. (See Correspondence.) As so high a practical authority as this gentleman has given so absolute and unqualified an endorsement of the introduction of the use of *glycerine*, as being the last remaining invention needed to render the wet meter a practically perfect instrument; the present editor of this Journal thinks it fitting here to put on record, or rather to renew upon the record, his own claim to this crowning invention. It was first made public at the meeting of the American Association for the Advancement of Science, at Baltimore, in April, 1858. The paper there read was published shortly after in *Silliman's Journal*. The passage describing this invention is, in part, as follows:

"I propose, therefore, as a substitute for both water and alcohol for filling gas meters, *glycerine*, sufficiently diluted to prevent its absorption of more water from the gas, and increasing in volume to any important extent, thus rendering the meter independent of attention within the ordinary limits of temperature."

This, we say, is the first publication to the world, but now add that the experiments on which the invention was based were made about *six years previous* to this, in the laboratory of Dr. John Torrey, at the old Medical College in Crosby street. They were at that time (1852) communicated privately to several gentlemen connected with the Manhattan Gas-Light Company, who all disparaged the idea (the commonest glycerine then cost $2 per lb). This discouraged the writer, and he failed to secure the invention by patent, as he at first determined to do. Many similar lessons are doubtless taught by experience to all those of us, who devote thought to the practical details of our pursuits in life. It was again his intention, at the time of the public communication in Baltimore, to obtain a patent, but becoming himself a Patent Office Examiner, was excluded by law from any such protection.

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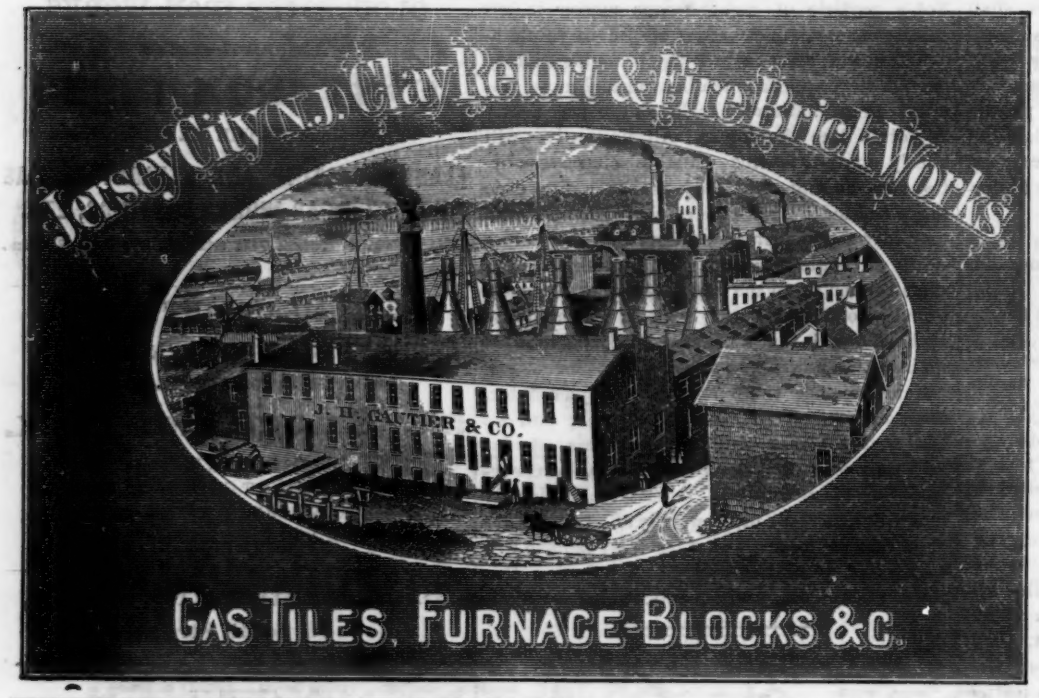

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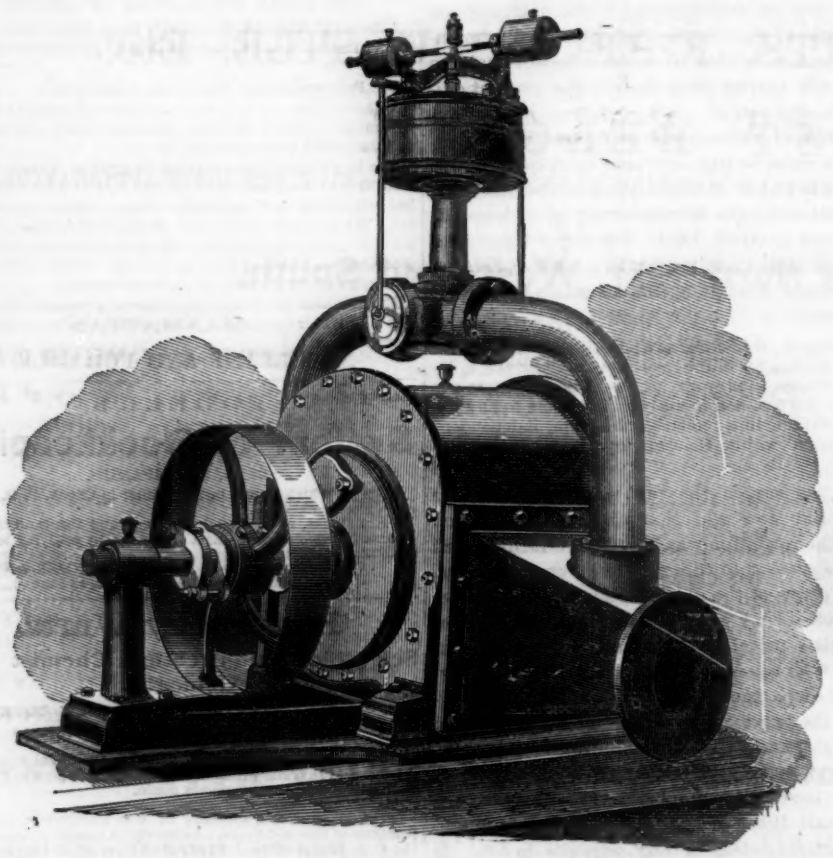

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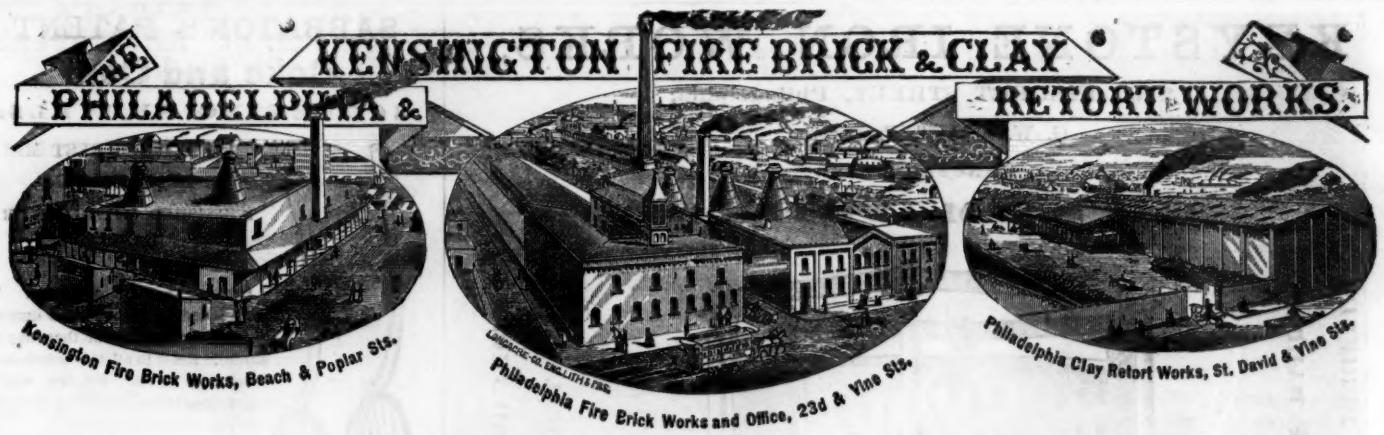
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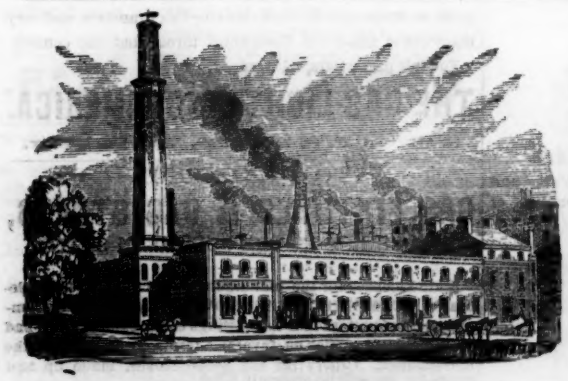

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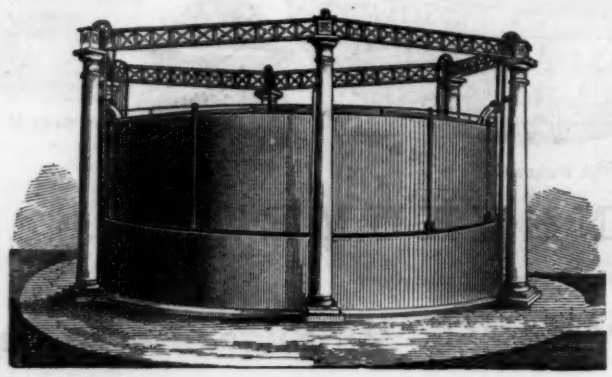

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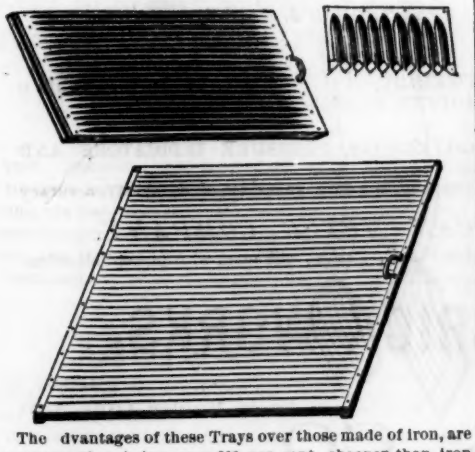

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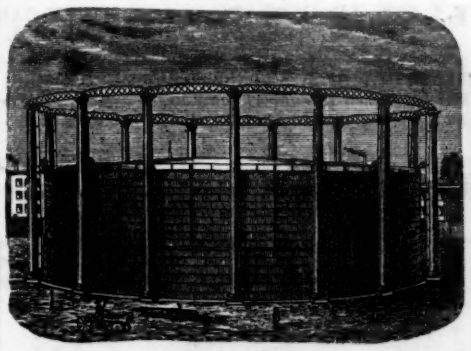

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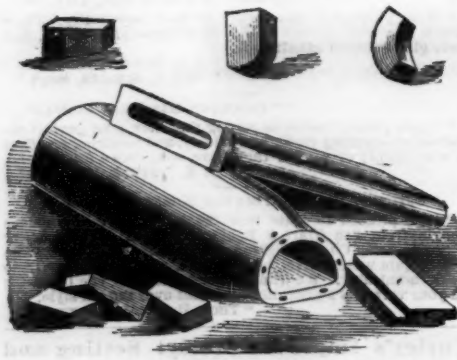

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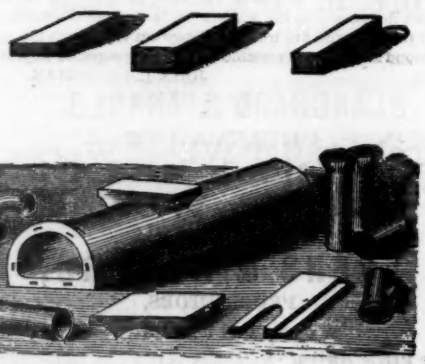

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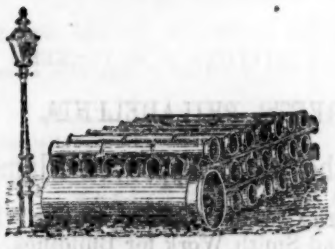

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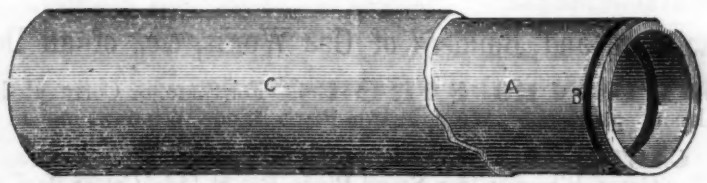

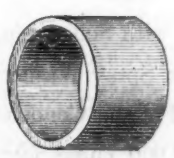

FIG. 2.

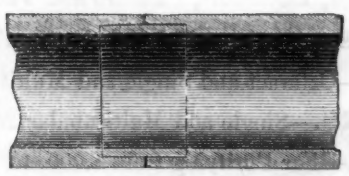

FIG. 3.

A—Cylinder of Wood. B—Band of Iron. C—Coating of Hydraulic or Asphaltum Cement.

FIG. 2.—Thimble for Connection. FIG. 3—Horizontal Section and Connection.

Above is a cut of the

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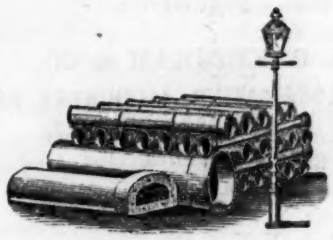

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